International Journal of Agricultural
Science and Research (IJASR)
ISSN(P): 2250-0057; ISSN(E): 2321-0087
Vol. 6, Issue 6, Dec 2016, 277-282
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DEVELOPMENT AND EVALUATION OF OSMOTIC DEHYDRATED JACK FRUIT CRISPS

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ABSTRACT

Jackfruit (Artocarpusheterophyllus L.) is one of the most popular tropical fruits grown in Asia. Jackfruit grows plentifully in the South and East of India. The present study was conducted to develop jack fruit crisp by using osmotic dehydration method and evaluation of physico-chemical (Moisture, Tritable Acidity, pH, TSS, Ascorbic acid, Reducing sugar and Total sugar), organoleptic, microbial and storage studies in three different packaging material(HDPE, LDPE & MLP) of jack fruit crisp. Standardization process for developing fruit crisps showed that an osmotic pretreatment with 55°brix sugar solution was more suitable for jackfruit crisps and further dehydration at 55 to 60 ℃ for 29hr gave a final product for further analysis and during 30 days storage, the results showed that crisps packed in metal laminated pouch showed the highest score.

KEYWORDS: Jack Fruit Crisps, Osmotic Dehydration, Physico-Chemical, Sensory, Storage, Packaging

Received: Oct 24, 2016**; Accepted:** Nov 11, 2016**; Published:** Nov 15, 2016**; Paper Id.:** IJASRDEC201641

Original Article

INTRODUCTION

The jack fruit (*Artocarpusheterophyllus*), also known as jack tree, jak fruit, or sometimes simply jack or jak, is a species of tree in the fig, mulberry and breadfruit family (Moraceae). It is native to parts of South and Southeast Asia and is believed to have originated in the south western rain forests of the Western Ghatsin the Indian Subcontinent. Jackfruit is the national fruit of Bangladesh. Fresh fruit has small amounts of vitamin-A and flavonoid pigments such as carotene-ß, xanthin, lutein and cryproxanthin-ß these compounds play vital roles in anti-oxidant and vision functions. Consumption of jackfruit rich in vitamin-A and carotenes has been found to protect from lung and oral cavity cancers. Jackfruit is also good source of anti-oxidant vitamin-C, provides about 13.7 mg or 23% of RDA. It is one of the rare fruits that is rich in B-complex group of vitamins. It contains very good amounts of vitamin B-6 (pyridoxine), niacin, riboflavin and folic acid. Fresh fruit is a good source of potassium, magnesium, manganese and iron. Potassium is an important component of cell and body fluids that helps controlling heart rate and blood pressure.

Many processing techniques can be employed to preserve fruits and vegetables. Drying / dehydration is one of the most important operation that is widely practiced because of considerable saving in packaging, storage etc (Chavan 2012).Osmotic dehydration is a method of preservation in which the food is dipped in concentrated

salt or sugar solutions. Osmotic dehydration is the phenomenon of removal of water from lower concentration of solute to higher concentration through semi permeable membrane resulting in an equilibrium condition on both sides of membrane (Tiwari 2005).The main advantages of osmotic dehydration include better colour, texture and flavour retention along with minimum heat damage (Ponting et al, 1996). The objective of the study was to investigate the development, physico-chemical, organoleptical, packaging and storage studies of jack fruit crisps.

METHODS

Raw Material

The Jack fruits were procuring from local market of Hyderabad. The experimental studies were carried out at the department of food and nutrition, post graduate and research center, PJTS Agricultural University, Rajendranagar, Hyderabad.

Sample Preparation

Jack fruit crisps were optimization with sulphur compounds then treated by using two levels of concentrated sugar solution that is 55 and 60°B (The sample to solution ratio was 1: 4) with 0.5% KMS and 1% citric acid. After addition bulbs to the sugar solution the mixture was kept for 4 hours of osmosis and then dried in tray dryer at 60°C 29 hr. Sensory evaluation conducted for jack fruit crisps at two different levels of concentrations 55°B and 60°B, from that best accepted product evaluated for further analysis.

Physico-Chemical Analysis

Moisture content was determined by drying the sample to a constant weight in a hot air oven at 100 to 105^0C for 4 hrs and the pH measured using pH meter. The total soluble solids content was determined by Digital Refractometer. Titrable Acidity It was determining by Titrating with 0.1 N NaOH. Total sugar and Reducing sugars were determined by Nelson- Somyogi method, Ascorbic acid content by titration method is using standard 2-6 di-chlorophenol indophenols dye solution.

Sensory Evaluation

Sensory evaluation for the osmotic dehydrated jack fruit crisps sample was carried out at laboratory level by trained panel of ten judges using score card of five point hedonic scale. Descriptive terms were given to various quality attributes like, color, flavor, crispiness, sweetness and overall acceptability and numerical scores were assigned.

Microbial Analysis

Microbial analysis of the samples during storage in terms of total bacterial count, yeast and mold counts they were determined using the plate count agar, acidified potato dextrose agar and sabouraud dextrose agar were expressed as long CFU g^{-1} of the samples all the determination were performed in duplicate and results were averaged.

Storage/ Shelf Life Studies

The osmotic dehydrated jack fruit crisps were packed in three different packaging materials, i.e. low density polyethylene pouch, high density polyethylene pouch and matal laminated aluminium pouch stored at ambient temperature for a period of 30 days and evaluated periodically initial, 15^{th} and 30^{th} day for any changes in physico-chemical and sensory quality attributes.

Consumer Acceptability

Consumer acceptability test was carried out in a few super market areas namely Balaji Grand and More Super Market at Hyderabad on different people. Samples of the osmotic dehydrated fruit crisps jack fruit were given for evaluation to 50 consumers using a 5-point hedonic scale as 5-excellent, 4- very good, 3-good, 2- fair and 1- poor.

Analysis of the Data

The data was analyzed by statistical analysis as per procedure outlined by Snedecor and Cochran, 1983. The means, standard deviation, percentages and Analysis of variance (ANOVA) were used for analyzing the data.

RESULTS AND DISCUSSIONS

Standardization

For standardization of the product a comparative evaluation of the product obtained at different levels of TSS for jack fruit crisps was done and sensory parameters like color, flavor, crispiness, sweetness and overall acceptability were evaluated by taste panel judges. The results are given in table 1.

Table 1: Sensory Score of Fruit Crisps While Standardization at different TSS Levels

Fruit Crisps	TSS (ºbrix)	Color	Flavor	Crispiness	Sweetness	Overall Acceptability	Total Score
Jack fruit	55	4.3±0.67	4.2±0.78	3.6±0.51	4.1±0.56	3.6±0.56	4.02±0.27
	60	4.2±0.63	3.9±0.73	3.7±0.67	3.4±0.96	3.9±0.73	3.82±0.29

Fruit crisps were developed using different levels of sugar concentrations of 55º to 60ºbrix. From the results of sensory evaluation, 55ºbrix was found more acceptable for jack fruit crisps hence the same TSS was used for the development of final product and for further analysis of shelf life and study of consumer acceptability.

Yield of Fruit Crisps

Weight of the slices reduced in osmosis and further decreased during dehydration. The average weight of fruit after osmotic treatment decreased to 15 per cent with weight loss jack fruit. The yield of jack fruit crisp was 43g per cent given in table 2.

Table 2: Yield of Fruit Crisps after Osmotic Dehydration

Fruit	Fresh Fruit (g)	Weight after Osmotic Treatment (g)	Percent weight Loss Due to Osmosis	Weight of Fruit Crisp(g)	Percent Yield of Fruit Crisp g/100g
Jack Fruit	216	183	15.2	93	43

Physico-Chemical Parameters

The initial moisture was found to be 3.48. Physico-chemical quality parameters during storage indicate that the LDPE packed dried jack fruit crisps gained more moisture as compared to other packages. No gain/loss in moisture was noticed in laminated pouches during storage period of 30 days. The increase in moisture content in polyethylene packed samples might be due their permeability to air and vapours as reported by sharma *et al*. for apple slices.

The initial TSS was found to be 60.33ºbirx in jack fruit crisps. The TSS slightly increased during storage was observed in all three packages without any significant difference in storage/ packs. The increase in TSS might be due to reduction in moisture content during storage. The results were showed in table 3.

The fresh jack fruit crisps had a Titrable acidity of 0.59%. No significant difference was observed within the samples stored for 15 and 30 days either in HDPE, LDPE or ML Packages compared to the initial of titrable acidity. The gradual and small reduction in titrable acidity during storage in HDPE and MLP pouches might be due to the utilization of acids during various biochemical reactions occurring in the products during storage. Reduction in ascorbic acid was observed during 30 days storage due to its oxidation and greater loss in LDPE might have been due to more availability of oxygen during storage. Similar results were also noticed by Ambrose and Sree narayanan (1998). The increasing trend of reducing sugar during storage irrespective of packaging was probably due to the hydrolysis of non-reducing sugars during storage. The low total sugar content of crisps packed in LDPE pouches could be due to higher moisture content, which might have favored faster non enzymatic reaction during storage

Table 3: The Physico- Chemical Composition of Jack Fruit Crisps Tested in Three Packaging Materials Stored for Initial, 15 and 30 Days

Constituents /100g	Before Storage/ Initial	HDPE		LDPE		Metalized		Probability Value	
		15 Days	30 Days	15 Days	30 Days	15 Days	30 Days	Storage Period	Packaging
Moisture (g)	3.48	4.80	4.90	5.40	5.40	3.48	4.76	3.63E-08	NS
pH	2.30	3.03	2.80	3.70	3.50	2.70	2.70	0.0002*	NS
Titrable Acidity	0.59	0.51	0.49	0.78	0.80	0.54	0.53	NS	NS
Ascorbic Acid(mg)	15.60	15.46	14.00	14.23	12.90	15.03	14.60	NS	NS
TSS (ºbrix)	60.33	61.66	62.00	68.00	68.30	66.60	63.00	NS	NS
Reducing Sugars(g)	9.46	10.86	11.26	13.30	13.26	9.46	11.13	0.0003*	NS
Total Sugars(g)	**62.90**	**61.83**	**63.10**	**62.90**	**62.10**	**63.50**	**64.03**	**NS**	**NS**

Organoleptic Evaluation

Table 4: Sensory Scores of Jack Fruit Crisps in Different Packaging Materials at Different Storage Periods

Parameters	Before Storage/Initial	HDPE		LDPE		MLP	
		15 Days	30 Days	15 Days	30 Days	15 Days	30 Days
Color	4.2±0.63	4.1±0.73	3.6±0.69	4.0±0.81	4.0±0.81	4.0±0.94	3.5 ± 0.84
Flavor	4.2±0.78	3.6±0.69	3.6±0.51	3.5±0.52	3.5±0.52	4.0±0.94	3.2 ± 0.69
Crispiness	3.8±0.91	3.3±0.94	3.2±0.63	3.4±0.84	3.3±0.67	3.4±0.69	3.2 ± 0.78
Sweetness	4.7±0.48	3.4±0.96	3.3±0.48	3.0±0.81	3.0±0.81	4.6±0.51	3.8 ± 0.63
Overall Acceptability	4.1±0.56	3.7±0.67	3.8±0.63	3.6±0.61	3.6±0.69	3.9±0.56	3.6 ± 0.51
Total Score	**21± 2.30**	**18.1± 1.7**	**17.5±0.97**	**17.5± 1.58**	**17.4±1.5**	**19.9±2.02**	**17.7± 1.56**

The color of jack fruit crisps was relatively stable up to 15 days in all the three packages HDPE, LDPE and MLP and during the storage period of 30 days the result shows that better color retention in LDPE compared to HDPE and MLP. Flavor of jack fruit crisps decreased during storage in all three packages. In general the mean score for crispiness of jack fruit crisps was which has decreased indicating that the longer the storage period the probability of jack fruit crisps becoming soft or soggy increases. Jack fruit crisps scored highest for sweetness 4.7 on the first day but the scores decreased by 15th and 30th day of storage in HDPE and LDPE. Whereas samples stored in MLP maintained same sweetness on the 15th day with a score of 4.6 but decreased to a score of 3.8 on the 30th day. The overall acceptability of jack fruit crisps scored 4.1, which has decreased on the 15th and 30th day in all the packages.

Microbial Analysis

The osmo dehydrated fruit crisps were in general found to be microbially safe for consumption during storage in HDPE, LDPE and MLP. Lower level of moisture, high concentration of sugars, TSS, acidity and addition of citric acid and KMS were the important factors that contributed to the microbial safety of jack fruit crisps. Freshly prepared fruit crisps showed SPC ranging from nil to 10 colonies/g, and total absence of yeast and mould. Similarly samples stored at 37ºc for 30 days showed SPC and yeast and mould counts to be negligible

Consumer Acceptability

The consumers tasted the samples and gave the score for the sensory attributes like color, flavor, crispiness, sweetness and overall acceptability to each fruit crisp and the results are presented in table 4. Fifty consumers evaluated the fruit crisps and gave their acceptability rating as excellent, very good, good, fair and poor. Jack fruit crisps were rated to have excellent color (20%), flavor (30%), crispiness (18%), sweetness (20%) and overall acceptability (26%).The rating was very good was given for color (34%), flavor (30%), crispiness (48%), sweetness (32%), and overall acceptability (44%).The rating was good was given for color (30%), flavor (32%), crispiness (30%), sweetness (34%), and overall acceptability (30%). The rating was fair was given for color (10%), flavor (8%), sweetness (4%), and overall acceptability (26%).

CONCLUSIONS

The preparation of jackfruit chips is very simple and can easily be processed. Considering physico-chemical parameters and sensory attributes like crispiness, colour, flavour and overall acceptability, metal laminated pouche was found most suitable for packaging of jackfruit chips. The prepared crisps can be stored at ambient condition keeping in metal laminated pouches for 30 days of storage without loss of organoleptic quality.

Consumer acceptance test indicated that the dehydrated jack fruit crisps packed in MLP pack obtained highest rating as it was better in terms of colour, flavor, crispiness and overall acceptability. Jack fruit bulbs dipped in 55^{o}B sugar solution and dried at 60^{o}C followed by packing in MLP was resulted in to chemical and sensory scores during 30 days of storage period.

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